



**MASSACHUSETTS DIVISION OF ENERGY RESOURCES
MASSACHUSETTS DEPARTMENT OF HOUSING AND
COMMUNITY DEVELOPMENT**

**REBUILD MASSACHUSETTS
ENERGY INFORMATION SYSTEM
DEMONSTRATION PROJECT**

September 20, 2005

Prepared by: Peregrine Energy Group

Executive Summary

This report describes the results of the first phase of an Energy Information System (“EIS”) Demonstration Project supported by the Rebuild Massachusetts program (Rebuild MA) and the Rebuild Massachusetts Public Housing Energy Efficiency Project (PHEEP). The Division of Energy Resources’ (DOER) Rebuild Massachusetts Program focuses on energy-saving solutions to increase energy efficiency improvements in existing buildings through private-public partnerships. The Massachusetts Department of Housing and Community Development (DHCD) is the lead agency managing PHEEP in partnership with Rebuild MA. The US Department of Energy funds both programs. DHCD also received funding from the Executive Office of Environmental Affairs.

The purpose of the EIS Demonstration Project (Project) is to determine whether a customized, web-based energy information system can eliminate the barriers that prevent public agencies in Massachusetts from gaining access to, and making effective use of, energy information, and thus enable those agencies to implement energy efficiency projects.

Energy information is the backbone of any successful energy management initiative. Public agencies require energy information for many purposes, including tracking spending against budget, assessing building operations, benchmarking, procuring energy supply & energy efficiency services and preparing mandatory year-end reports.

Unfortunately, there are numerous barriers that prevent public agencies from gaining access to, and making effective use of, energy information. For public agencies, the primary source of energy usage information is their utility bills. However:

- There is no readily available analytical connection between utility bills, building performance, and occupant energy and water use.
- There is limited access to utility bills by the agency personnel responsible for energy management and building performance.
- Paper utility bills, which end up in file cabinets after payment is processed, are not an effective energy management tool. Where schools and other agencies have developed or purchased utility bill accounting software, they are typically unable to keep up with the labor-intensive, manual entry of the utility data into the software or justify the associated cost.

Because of these barriers, many public agencies do not have useable energy information and, consequently, numerous energy efficiency opportunities are being lost.

This Demonstration was designed to address these barriers through an online energy information system. The core features of the EIS include regular automated meter data collection and Web publishing to provide timely information to many people in many locations. Through automated data collection and reporting, the system reduces time and effort for users and promotes data consistency.

The Demonstration Project targeted buildings from the Amesbury, Lawrence & the Boston Housing Authorities, and the Newton School District. It also focused on addressing some of the specific data needs of DHCD in its oversight of a statewide portfolio of public housing.

Over the first phase, the project activities included:

- Working with the agencies and their utility providers to collect utility and building data.
- Creating data tables and populating them with the utility and building data.
- Establishing a secure central server to store the data.

Fundamental lessons learned over the first phase concerned the collection of utility and building data. Collection of utility data electronically will be critical, as public agencies do not have the resources to enter this data manually. Most Massachusetts utilities make billing data available electronically, but use many different protocols and file formats. The EIS must be able to accommodate these different approaches.

With regard to building data, there is very little available online. Having explored numerous data sources, it is clear that individual customers are consistently the best sources for customer specific building information. To streamline the process for collecting this data, the EIS project has developed predefined spreadsheets for use in assembling data. Utility energy efficiency programs can play a valuable role in collecting building information. Building information collected for the Boston Housing Authority through the Rebuild Boston program (supported by NSTAR Electric and Keyspan) was of great use in gathering data for the EIS.

A key task over the next phase of the project will be developing standard and custom reports designed to meet the needs of each agency. The reports will enable users to:

- Monitor and benchmark building performance
- Provide information required for annual reports
- Support energy services performance contracts
- Monitor and verify savings achieved pursuant to such contracts

Additional tasks will include enhancing the user interface and refining data collection and reporting to enable enhanced analysis of usage at the agency level.

Introduction

This report describes the results of the first phase of an Energy Information System (“EIS”) Demonstration Project supported by the Rebuild Massachusetts program (Rebuild MA) and the Rebuild Massachusetts Public Housing Energy Efficiency Program (PHEEP) in partnership with Peregrine Energy Group.

Rebuild Massachusetts Program

Rebuild Massachusetts is a community-wide program presented by the Massachusetts Division of Energy Resources to promote energy & water efficiency and support reuse/rehabilitation in schools, municipalities, and public housing. The program focuses on energy-savings solutions to increase energy-efficiency improvements in existing buildings through private-public partnerships. It provides business and technical tools, customized assistance, and information on alternative financing mechanisms to enable building owners and community leaders successfully plan and carry out building energy projects that improve building performance and reduce energy use and costs. Rebuild provides energy efficiency outreach, education, and technical assistance.

The program strategy is built around a co-operative approach with a wide stakeholder base involved in its implementation. Identification of the barriers to energy efficiency and taking the first demonstrative measures to implement the strategy is realized through:

- Building institutional capacity of the local stakeholders for planning, evaluation, initiation, and implementation of different strategies and available energy efficiency measures and technologies.
- Demonstrating the technical, economic and financial feasibility of the initiative by applying selected energy efficiency measures and technologies.
- Disseminating the information and project experience throughout the state and national Rebuild program.

The expected outcome of this endeavor is a description of the key barriers relevant to energy efficiency projects and a strategy formulated for their removal. The feasibility of proposed measures is assessed through analyses of the different strategies, taking into account the local economic aspects including savings potential and financial & staff resources. Further information is available on the [Rebuild Massachusetts](#) web site.

Rebuild Massachusetts Public Housing Energy Efficiency Project

The Massachusetts Department of Housing and Community Development (DHCD) manages PHEEP. PHEEP supports efforts to identify, examine and implement energy and water efficiency investments in state-assisted developments at housing authorities. The US Department of Energy funds both Rebuild MA and PHEEP. DHCD also received funding under a sustainable development grant from the Massachusetts Executive Office of Environmental Affairs

The EIS Demonstration Project

The purpose of the EIS Demonstration Project is to determine whether a customized, web-based energy information system can eliminate the barriers that prevent public agencies in Massachusetts from gaining access to, and making effective use of, energy information, and thus provide an easy method to enable those agencies to implement energy efficiency projects.

The Demonstration Project will run for the 21-month period from January 2005 to September 2006. This report covers the results of the first six months of activity.

The report is divided into the following sections:

Section 1: Introduction

Section 2: Energy Information: Uses and Barriers describes the importance of energy information and the barriers that impede public agencies in Massachusetts from gaining access to, and making effective use of, that information.

Section 3: Web-Based Energy Information System describes the EIS, including its features and approach.

Section 4: EIS Demonstration Project describes the agencies targeted by the Demonstration Project.

Section 5: Lessons Learned describes the lessons learned to date.

Section 6: Sample Housing Authority Case Study provides a case study of one demonstration project agency.

Section 7: Next Steps discusses the next steps for the Demonstration Project.

Energy Information: Uses and Barriers

Energy information is the backbone of any successful energy management initiative.

Public agencies require energy information for many purposes, including to:

- Review building portfolio performance
- Track spending against budget
- Benchmark
- Identify energy efficiency opportunities
- Package utility and building information for energy efficiency investments, such as energy performance contracts
- Monitor the performance of energy efficiency investments
- Integrate utility monitoring with ongoing operation and maintenance best practices
- Prepare mandatory year-end reports for supervisory agencies such as DHCD

For public agencies, the primary source of energy usage information is their utility bills.

Unfortunately, numerous barriers prevent public agencies in Massachusetts from acquiring and effectively using this energy information.

- **There is no readily available analytical connection between utility bills, building performance, and occupant energy and water use.** Utility bills are designed to be invoice documents, not energy management documents. While they report usage recorded by a particular meter, they provide no building information. Utility bills tell customers how much they used and what they owe, but don't tell them whether they used too much given the size, age, condition, number of occupants, and energy end uses in the building.
- **There is limited access to utility bills by the agency personnel responsible for energy management and building performance.** Utility bills are typically sent to accounting departments. While these departments are important stakeholders, their priority is to pay bills accurately and on time. Measurement and management of energy usage is outside their scope. Moreover, access to the bill information by other departments is typically quite limited.
- **Paper utility bills, which end up in file cabinets, are not an effective energy management tool.** Where schools and other agencies have developed or purchased utility bill accounting software, they are typically unable to keep up with the labor-intensive manual entry of the utility data into the software. Inability to maintain utility bill databases is a primary reason for the failure of energy information systems in public agencies.

Because of these barriers, many public agencies do not have useable energy information and, therefore, numerous energy efficiency opportunities are being lost. Rebuild MA and PHEEP undertook a demonstration project to determine whether these barriers could be addressed through a web-based energy information system. This system is described in the following section.

Web-Based Energy Information System

The EIS is a web-based system designed to address the real-world energy information needs of building managers:

- Fast and simple identification, collection, and integration of baseline utility and building information (energy and water end uses, meter locations, and related account information)
- An effective tool for energy analysis, data management, prioritization of energy efficiency investments, and ongoing monitoring and verification of energy cost reductions
- Scalability to match the agency's requirements for utility reporting and available management resources

EIS Features

The EIS contains the following features that facilitate access to and use of energy information

- **Keyless entry of utility bills** – automates data collection
- **Integration of utility bill usage information and building and energy end-use information** – links utility bill information with building performance
- **Point and click access** -- makes information easy to get to
- **Standard and custom reports** – provides useful information in the form users want
- **Automated report generation and distribution** –allows easy, simultaneous sharing of information with all stakeholders in energy management, including accounting, executive administration, property management, and maintenance personnel

EIS Approach

The EIS uses a five-step process to make useful energy information available to public agencies:

- Collect utility and building data
- Assemble utility and building data into data tables
- Analyze data
- Generate and distribute reports
- Update utility data over time

These five steps are explained in more detail below and are illustrated in the flow chart attached as Appendix A.

FIVE STEPS TO PROVIDE ENERGY INFORMATION

Step 1: Collect Utility and Building Data

Utility Data: Utility data includes electric, gas, water, and oil billing and usage data. Downloading electronic data directly from utilities wherever possible collects the data. There is a small amount of Data that is not available electronically that is entered manually. Typically, one to three years of historic data is collected.

Building data: Building data includes: building addresses; square footage; number of units; number of bedrooms; energy use categories, such as heating, lighting, and appliances, and sub-categories such as heating system type; and who pays the utility bills. The data is collected and matched to utility accounts.

Step 2: Integrate Utility and Building Data into Data Tables

Step two involves creating data tables in a relational database and populating those tables with the utility and building data collected in step one.

Step 3: Analyze Data and Convert to User-Specified Information

In step three, the EIS analyzes and consolidates the utility and building data into manageable building performance tables. The tables include standard energy performance information such as total cost, total use, and average price. In addition, they include more detailed building performance indices selected by individual agencies, such as MBtu/sf and gallons/apt/day.

Step 4: Generate and Distribute Reports

The EIS generates regular reports that are designed to meet the needs of each agency and the specific needs of individuals within each agency. For example, the executive director of a housing authority might want a report showing the performance of the development as a whole. A facility manager might want a report showing the performance of his facility and perhaps a report comparing his facilities to others. Site maintenance personnel might want reports identifying high usage accounts. The accounting department might want reports showing utility price trends and reports providing the information that the housing authority must report to DHCD. The EIS is designed to generate the range of reports that users require.

The EIS distributes reports via e-mail on a subscription basis. The EIS administrator can establish a report distribution list and can designate which reports are sent to which individuals and the frequency of distribution.

The EIS reports are designed to be easy-to-use. They use HTML to embed graphs and detailed reports in hyperlinks from summary reports. Users can “drill down” and view graphs or data that are more detailed simply by clicking on links in the summary report.

Step 5: Update and Refresh Utility Data

Each month the EIS updates and refreshes the utility data tables for each agency. Data that is available online is collected automatically.

The Rebuild MA and PHEEP made the EIS project available to public agencies to determine whether it can eliminate the barriers that prevent those agencies from gaining access to, and making effective use of, energy information, and thus provide an easy method to enable those agencies to implement energy efficiency. The Demonstration Project is described in the following section.

Demonstration Project

The Demonstration Project scope addresses the varying needs of the Rebuild MA and PHEEP programs.

Rebuild Massachusetts

For Rebuild MA, the EIS Demonstration Project targets public sector agencies that are actively involved with the program. As the initial group of participants, Rebuild MA selected buildings from the Lawrence Housing Authority, Boston Housing Authority, and Newton School District.

Over the initial phase, demonstration project activities included:

- Working with agencies and their utility providers to collect utility and building data.
- Creating data tables and populating them with the utility and building data.
- Establishing a secure central server to store the data.

As is discussed in more detail in Section 7 of this report, a key task over the next phase will be developing standard and custom reports designed to meet the needs of each agency. For example, for schools, the EIS will provide an on going “manage by measurement” tool to complement the energy education objectives of the US DOE EnergySmart Schools program. The information in the reports will be designed for a range of education levels so that the energy consumption of the building can be used in ongoing school science curriculum.

Public Housing Energy Efficiency Project

For PHEEP, the Demonstration Project provided DHCD-specific technical support. The project focused on integrating several types of data (inventory, Geographic Information Service) with the EIS to improve DHCD’s ability to manage water and energy usage and related efficiency improvements in their building portfolio. The project also worked with DHCD to determine the best means of handling massive amounts of data downloaded from utilities and coordinating the databases of utility information with DHCD and Lawrence Housing Authority inventory, equipment, and apartment databases.

As is discussed in more detail in section seven of this report, a key task over the next phase of the project will be developing standard and custom reports designed to meet the needs of both DHCD and the individual housing authorities. For example,

- Reports providing building-by-building utility consumption analysis in individual developments, use per apartment, use per square foot, and water leak detection.
- Reports designed for procurement of energy services performance contracts and for monitoring and evaluation of savings realized pursuant to those contracts.

In addition, the project will seek opportunities to coordinate with other housing agencies such as MassHousing and the US Department of Housing and Urban Development.

Lessons Learned

Utility Data Collection

The input of utility data is one of the greatest challenges involved in providing effective energy information services to public agencies in Massachusetts. Given their many other responsibilities, agency staff simply does not have time to enter utility data manually.

Accordingly, utility direct data collection needs to be automated to the greatest extent possible. This applies both to the entry of historic information and the entry of new information over time.

Automated data collection itself has challenges. While many Massachusetts utilities and energy suppliers provide electronic data, they use different protocols and data formats, including web pages, Excel spreadsheets, ASCII files, and email. The EIS must be sufficiently robust to accommodate all of these approaches.

One of the key elements of the EIS is automated data collection, however many municipal utilities simply do not provide electronic data in any format. Therefore, it might not be possible to avoid manual data entry altogether. To address these unique circumstances, the EIS is streamlining the process for entering manual data by developing predefined, data-entry spreadsheets designed specifically for target audiences, e.g., housing authorities and schools.

Building Data Collection

The collection of building data presents another challenge to providing effective energy management information services to public agencies.

In Massachusetts, there is very little building data available online. The demonstration project identified and investigated two online data sources: online city assessor databases and some Geographic Information System (GIS) services. However, we found that this data was not adequate.

Having explored numerous data sources, it is clear that individual customers are consistently the best sources for customer specific building information. To streamline the process for collecting data, the EIS project has developed predefined, data-entry spreadsheets.

For public housing, DHCD is an important additional source of building data. DHCD provided the Demonstration Project numerous data sources, including a CHIS data table, utility data tables for National Grid and Western Massachusetts Electric, an energy intensity data table, a list of all housing authorities with the total number of apartments per housing program and the total number of federally-funded apartments, and more detailed utility data for specific housing authorities. Individual development site plans might be available from DHCD on an as-needed basis to help identify utility meter and building location and end-use relationships. However, generally they are not readily accessible. Developments that are undergoing or have recently undergone capital improvements are more likely to have site drawings than other developments.

Utility energy efficiency programs can play a valuable role in collecting building information. In 2001, NSTAR Electric, Keyspan, and Rebuild Boston assisted the Boston Housing Authority (BHA) in preparing an Energy Master Plan for its entire building portfolio. The Energy Master Plan included multiple data tables of building-related information. Most of this information was collected onsite and from copies of original building plans. In addition, the Energy Master Plan located all of the meters in the buildings that were surveyed and the apartment energy use subcategories each meter served. This information accelerated the collection of building and utility data for the five state-funded developments included in the Demonstration Project.

Lessons Learned by Agency

Following is a summary of building and utility information “lessons learned” by agency.

- **Amesbury Housing Authority** – Building data for the Amesbury Housing Authority (AHA) came from AHA and DHCD. Building data from AHA included Excel spreadsheets with meter account information listed by development and by building, development construction completion summary with numbers of apartments and size of apartments. Additional building data came from oral confirmation of building energy end uses with AHA’s business manager. Building data from DHCD included a filtered report from DHCD’s CIIS Data Table.
- **Lawrence Housing Authority** – The Lawrence Housing Authority (LHA) had detailed building information for two of their two state-funded developments. LHA had hired a consultant to collect this information and analyze the energy performance of these developments for an energy performance contract savings guarantee contract review. LHA’s building information includes energy audit documentation, precise meter location and end use information, documentation of energy and water-related capital investment installations, and the consultant’s analysis. One other LHA development has equivalent building information that was collected for an earlier energy performance contract. Building data for the rest of LHA’s building portfolio will need to be collected from LHA management. For future potential consideration, LHA staff has installed a comprehensive energy management system in all of their developments. Trending data from this system could be collected to enhance the analysis of LHA’s building energy use and mechanical system performance.
- **Boston Housing Authority** – As noted above, the work done for the energy master plan in 2001 greatly accelerated the collection of building and utility data for the five state-funded developments included in the Demonstration Project.

In anticipation of collecting building information for other housing authorities that do not have an energy master plan, Peregrine and DHCD investigated several alternative building resources, including GIS-related data, City Assessor data, and scanned copies of the original building site plans. The Energy Master Plan data combined with a BHA supplied apartment inventory list provide the most complete building information. The other building information resources were less useful.

- **Newton Schools** - Newton schools' energy manager prepared a spreadsheet with building square footage and associated utility account information. This information has been uploaded into the EIS database. Newton has contracted with an online maintenance and utility consumption service called School Dude© (a Rebuild America Allied Business Partner) to upgrade their internal maintenance and inventory practices. Several other cities and towns throughout Massachusetts and New England have procured similar services. Rebuild MA has uploaded a substantial amount of utility and building data onto the online EIS database and is ready to move forward with Newton to coordinate Rebuild's EIS resources with Newton's School Dude© services.

Sample Housing Authority Case Study

The following case study describes the project's efforts to date with a housing authority (Sample HA)

The Sample HA is served by an investor-owned electric utility, an investor-owned gas utility, a municipal water department, and a competitive electricity supplier.

Sample HA's business manager prepared an Excel spreadsheet with the utility accounts summarized by development. All of the electric and gas utility data was available online; the water data was available in hard copy. EIS staff requested and entered sample water bills into the utility data table. Further discussions with the Sample HA's water department MIS director are underway to identify ways to access water data electronically. If this is unsuccessful, then additional water data will need to be entered from hard copies of the water bills or from manual water meter readings. EIS project staff did not request or enter utility bill information for the individually metered, tenant-paid utility accounts or the electricity supplier bills. Appendix B provides examples of the EIS data tables for HA, including the account, building, end use, and "who pays the bill" data tables.

EIS Snapshots

Following are a series of snapshots taken from the EIS website. The snapshots provide preliminary examples of information the EIS can provide. The next key step for the project is to develop the reports that will present this information in the form that is most useful for the Sample HA and DHCD.

Electric and Gas Cost

Figure 1 is a screen print of the 2004 total electric and gas cost for the five developments for which HA pays the electric and gas bills. Gas bills for one development and the water bills for all of the developments need to be entered into the data table to complete the total cost summary.

FIGURE 1: 2004 ELECTRICITY AND GAS COST

| YEAR | AGENCY | PROGRAM | DEVELOPMENT | ELECTRIC-Cost(\$) | GAS-Cost(\$) |
|------|-----------|---------|--------------|-------------------|---------------|
| 2004 | Sample HA | 667 | 1 | 4,319 | 2,893 |
| 2004 | Sample HA | 667 | 2 | 4,892 | . |
| 2004 | Sample HA | 667 | 3 | 5,256 | . |
| 2004 | Sample HA | 667 | 4 | 28,777 | . |
| 2004 | Sample HA | 705 | 7 | 9,545 | 12,129 |
| | | | Total | 52,789 | 15,022 |

Apartment Electricity Consumption

The individual meters at one development provide an opportunity to look at individual apartment energy consumption. Figure 2 summarizes the annual electric consumption (kWh) for ten similar three-bedroom apartments.

FIGURE 2: ANNUAL ELECTRICITY CONSUMPTION PER APARTMENT (kWh)

| YEAR | AGENCY | PROGRAM | DEVELOPMENT | UNIT | ELECTRIC-kWh |
|--------------|-----------|---------|-------------|------|---------------|
| 2004 | Sample HA | 705 | 7 | 28 | 11,679 |
| 2004 | Sample HA | 705 | 7 | 35 | 11,632 |
| 2004 | Sample HA | 705 | 7 | 37 | 9,838 |
| 2004 | Sample HA | 705 | 7 | 32 | 8,929 |
| 2004 | Sample HA | 705 | 7 | 30 | 8,320 |
| 2004 | Sample HA | 705 | 7 | 36 | 7,521 |
| 2004 | Sample HA | 705 | 7 | 38 | 6,665 |
| 2004 | Sample HA | 705 | 7 | 31 | 6,628 |
| 2004 | Sample HA | 705 | 7 | 34 | 6,203 |
| 2004 | Sample HA | 705 | 7 | 33 | 5,179 |
| Total | | | | | 82,594 |

Drilling down further, Figure 3 shows the monthly electricity use for a single apartment.

FIGURE 3: APARTMENT 28 MONTHLY ELECTRICITY CONSUMPTION (kWh)

| YEAR | MONTH | AGENCY | PROGRAM | DEVELOPMENT | UNIT | ELECTRIC - kWh |
|------|-------|-----------|---------|-------------|--------------|----------------|
| 2004 | 1 | Sample HA | 705 | 7 | 28 | - |
| 2004 | 2 | Sample HA | 705 | 7 | 28 | 941 |
| 2004 | 3 | Sample HA | 705 | 7 | 28 | 951 |
| 2004 | 4 | Sample HA | 705 | 7 | 28 | 873 |
| 2004 | 5 | Sample HA | 705 | 7 | 28 | 977 |
| 2004 | 6 | Sample HA | 705 | 7 | 28 | 1,236 |
| 2004 | 7 | Sample HA | 705 | 7 | 28 | 1,292 |
| 2004 | 8 | Sample HA | 705 | 7 | 28 | 1,242 |
| 2004 | 9 | Sample HA | 705 | 7 | 28 | 1,389 |
| 2004 | 10 | Sample HA | 705 | 7 | 28 | 846 |
| 2004 | 11 | Sample HA | 705 | 7 | 28 | 973 |
| 2004 | 12 | Sample HA | 705 | 7 | 28 | 959 |
| | | | | | Total | 11,679 |

Apartment Gas Consumption

Figure 4 summarizes the annual gas consumption (Therms) for the apartments in the same sample development.

FIGURE 4: ANNUAL GAS CONSUMPTION PER APARTMENT (THERMS)

| YEAR | AGENCY | PROGRAM | DEVELOPMENT | UNIT | GAS-Therms | GAS-Cost per Therm (\$) |
|------|-----------|---------|-------------|--------------|--------------|-------------------------|
| 2004 | Sample HA | 705 | 7 | 30 | 1,504 | 1.33 |
| 2004 | Sample HA | 705 | 7 | 28 | 1,447 | 1.28 |
| 2004 | Sample HA | 705 | 7 | 36 | 1,165 | 1.41 |
| 2004 | Sample HA | 705 | 7 | 32 | 1,136 | 1.33 |
| 2004 | Sample HA | 705 | 7 | 34 | 1,029 | 1.34 |
| 2004 | Sample HA | 705 | 7 | 35 | 882 | 1.39 |
| 2004 | Sample HA | 705 | 7 | 38 | 877 | 1.38 |
| 2004 | Sample HA | 705 | 7 | 33 | 846 | 1.39 |
| 2004 | Sample HA | 705 | 7 | 37 | 827 | 1.39 |
| | | | | Total | 9,713 | 1.38 |

Figure 5 shows monthly electricity use for a single apartment.

FIGURE 5: APARTMENT 30 MONTHLY GAS CONSUMPTION (THERMS)

| YEAR | MONTH | AGENCY | PROGRAM | DEVELOPMENT | UNIT | GAS-Therms | GAS-Cost per Therm (\$) |
|------|-------|-----------|---------|-------------|--------------|--------------|-------------------------|
| 2004 | 1 | Sample HA | 705 | 7 | 30 | 323 | 1.16 |
| 2004 | 2 | Sample HA | 705 | 7 | 30 | 277 | 1.19 |
| 2004 | 3 | Sample HA | 705 | 7 | 30 | 152 | 1.29 |
| 2004 | 4 | Sample HA | 705 | 7 | 30 | 123 | 1.32 |
| 2004 | 5 | Sample HA | 705 | 7 | 30 | 85 | 1.23 |
| 2004 | 6 | Sample HA | 705 | 7 | 30 | 77 | 0.98 |
| 2004 | 7 | Sample HA | 705 | 7 | 30 | 60 | 1.04 |
| 2004 | 8 | Sample HA | 705 | 7 | 30 | 61 | 1.09 |
| 2004 | 9 | Sample HA | 705 | 7 | 30 | 62 | 1.06 |
| 2004 | 10 | Sample HA | 705 | 7 | 30 | 67 | 1.04 |
| 2004 | 11 | Sample HA | 705 | 7 | 30 | 94 | 1.15 |
| 2004 | 12 | Sample HA | 705 | 7 | 30 | 123 | 1.33 |
| | | | | | Total | 1,504 | 1.33 |

Apartment Water Consumption

Even with the limited water bill data EIS staff has been able to collect to date, it is possible to identify some important water consumption trends. For example, Figure 6 shows which developments have the highest water use per apartment and which have the lowest. Comparison with water consumption in other housing authorities will most likely indicate the water use in the “high use” developments is about average compared to other buildings and the water use in the “low use” developments are quite low compared to other buildings.

FIGURE 6: WATER USE – GALLONS/ APARTMENT/ DAY

| YEAR | MONTH | AGENCY | PROGRAM | DEVELOPMENT | WATER- Gal per Apt per Day |
|-------------|--------------|---------------|----------------|--------------------|---------------------------------------|
| 2005 | 2 | Sample HA | 705 | 1 | 222 |
| 2004 | 9 | Sample HA | 200 | 2 | 218 |
| 2004 | 9 | Sample HA | 705 | 1 | 124 |
| 2005 | 2 | Sample HA | 667 | 4 | 62 |
| 2005 | 2 | Sample HA | 667 | 3 | 58 |
| 2004 | 11 | Sample HA | 667 | 5 | 49 |
| | | | | Average | 122 |

Next Steps

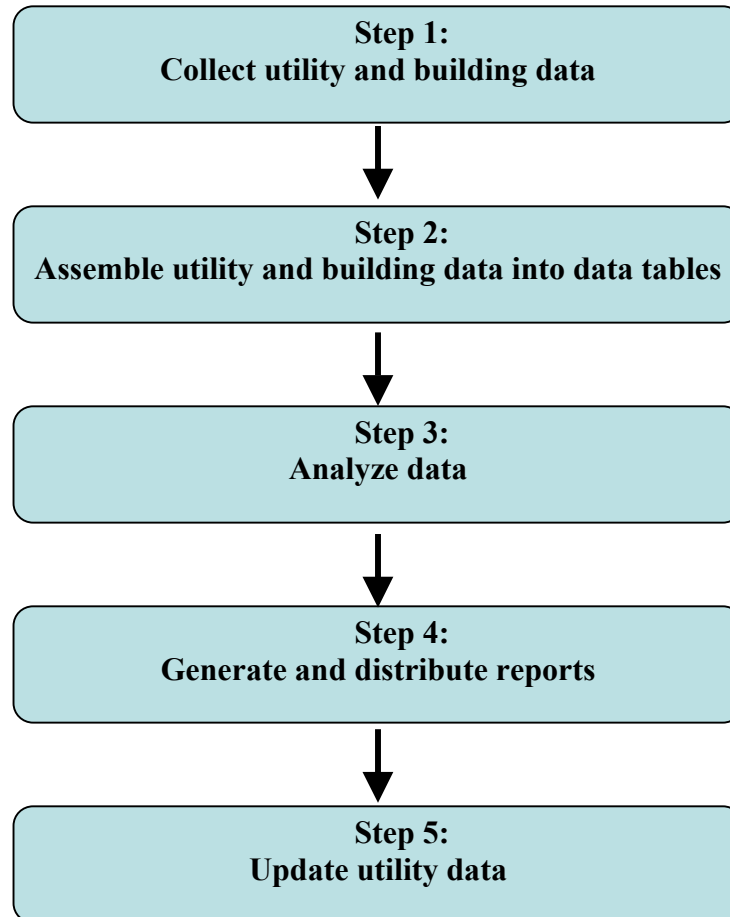
For the next phase, the EIS Demonstration Project has set the following priorities:

- Support Newton Schools energy management project
- Inform and identify program support/collaboration opportunities with Rebuild MA utility partners
- Upgrade EIS reports:
 - DHCD energy data table
 - Energy service performance contract¹ (ESPC) utility procurement data
 - Monthly performance report
 - ESPC-specific monitoring and verification report (same as non-ESPC monthly performance report with the addition of ESPC-specific financial analysis)

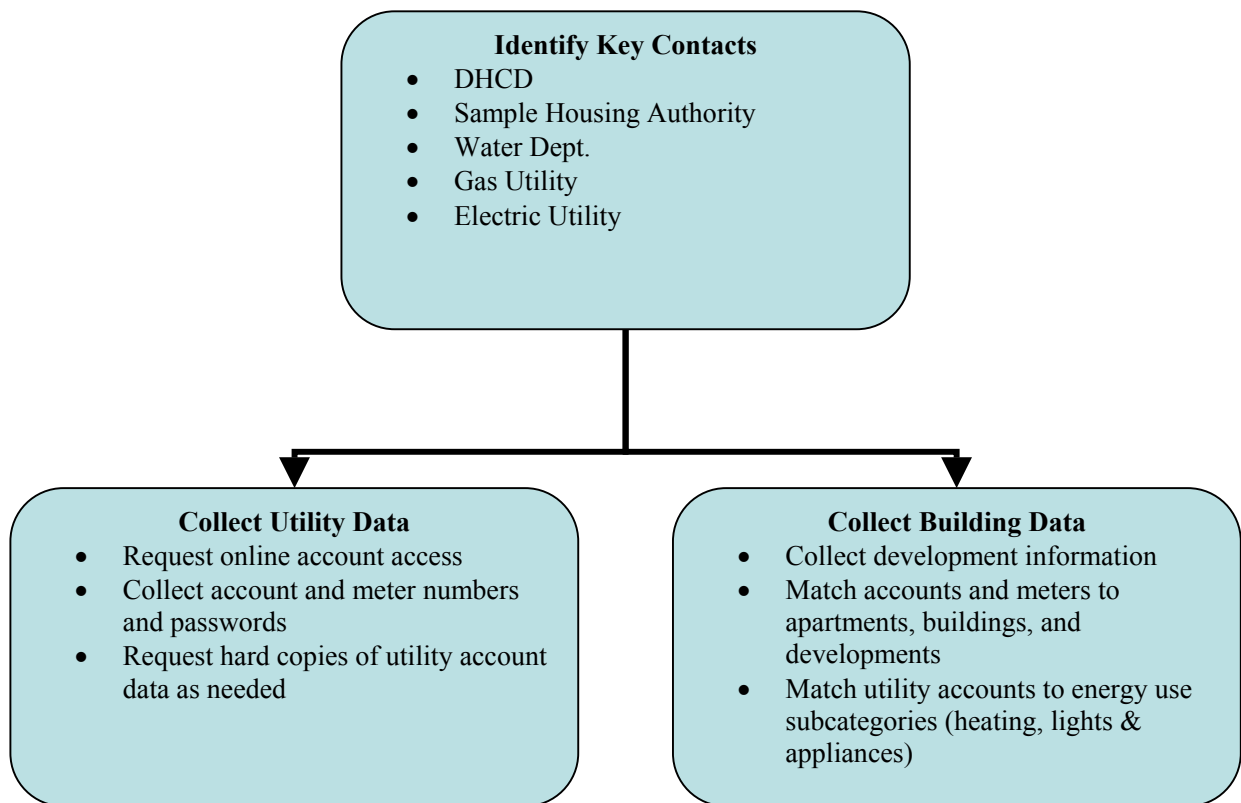
¹ M.G.L. c.25A §11C authorizes procurement for energy and utility conservation services, and cogeneration, known as energy management services (EMS). EMS is a type of performance contracting.

Appendix A: Flow Charts

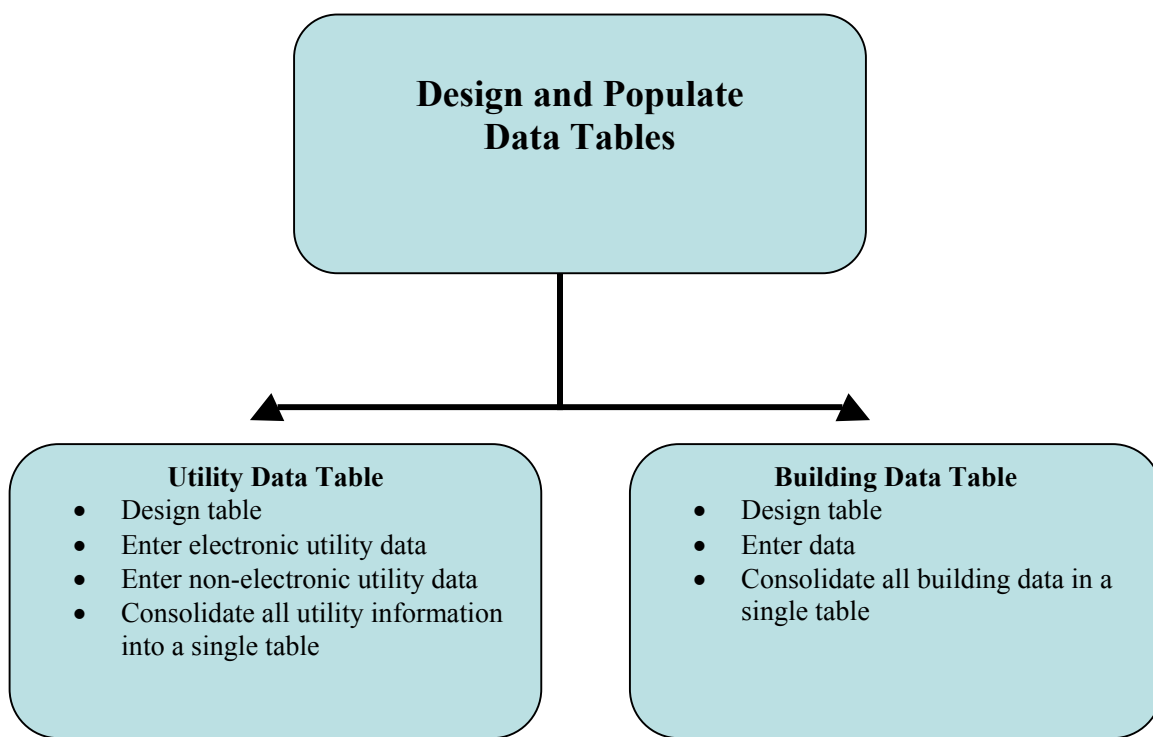
The following flow charts summarize the five-step EIS process, using a Sample Housing Authority as an example. The five steps are:



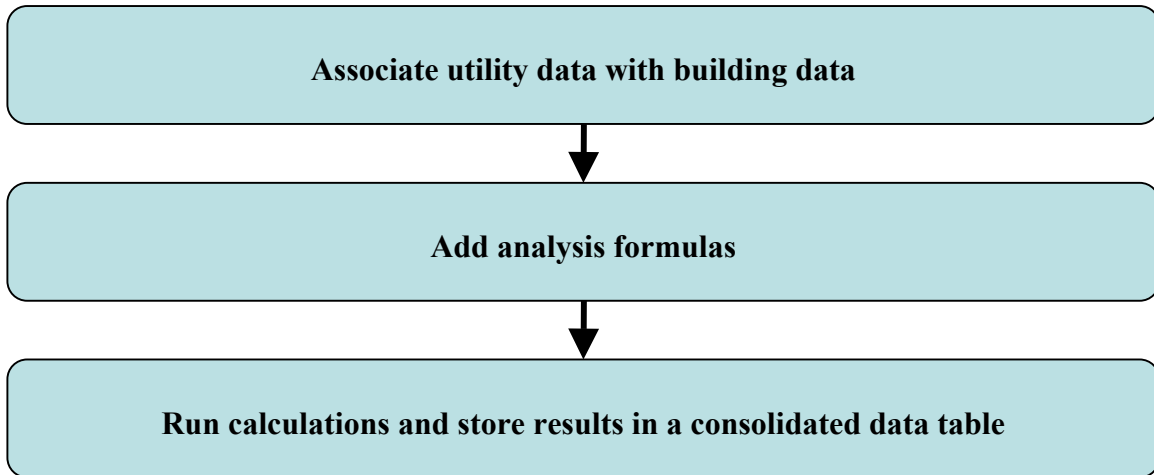
Step 1: Collect Utility and Building Data



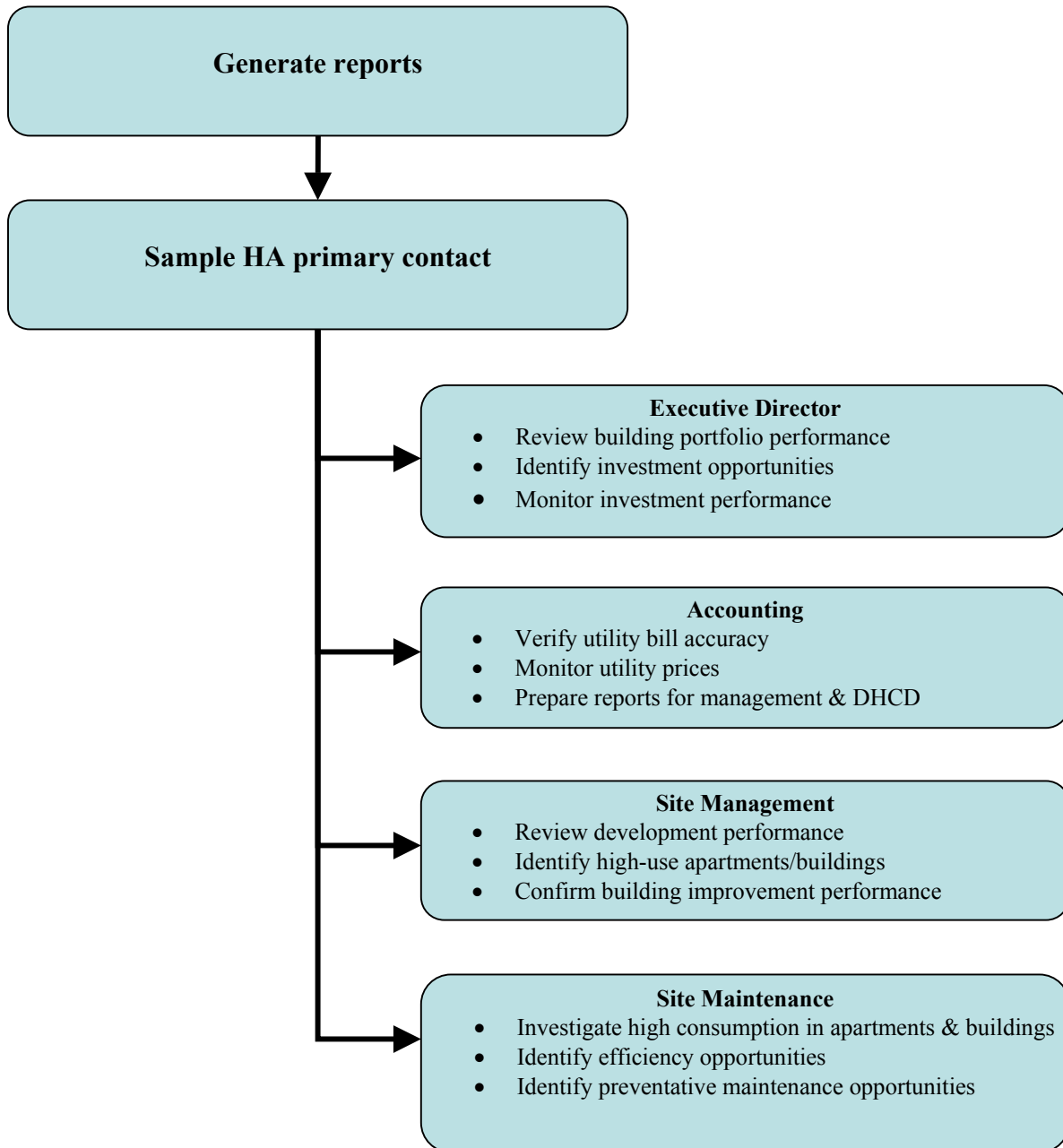
Step 2:
Assemble Utility and Building Data into Data Tables



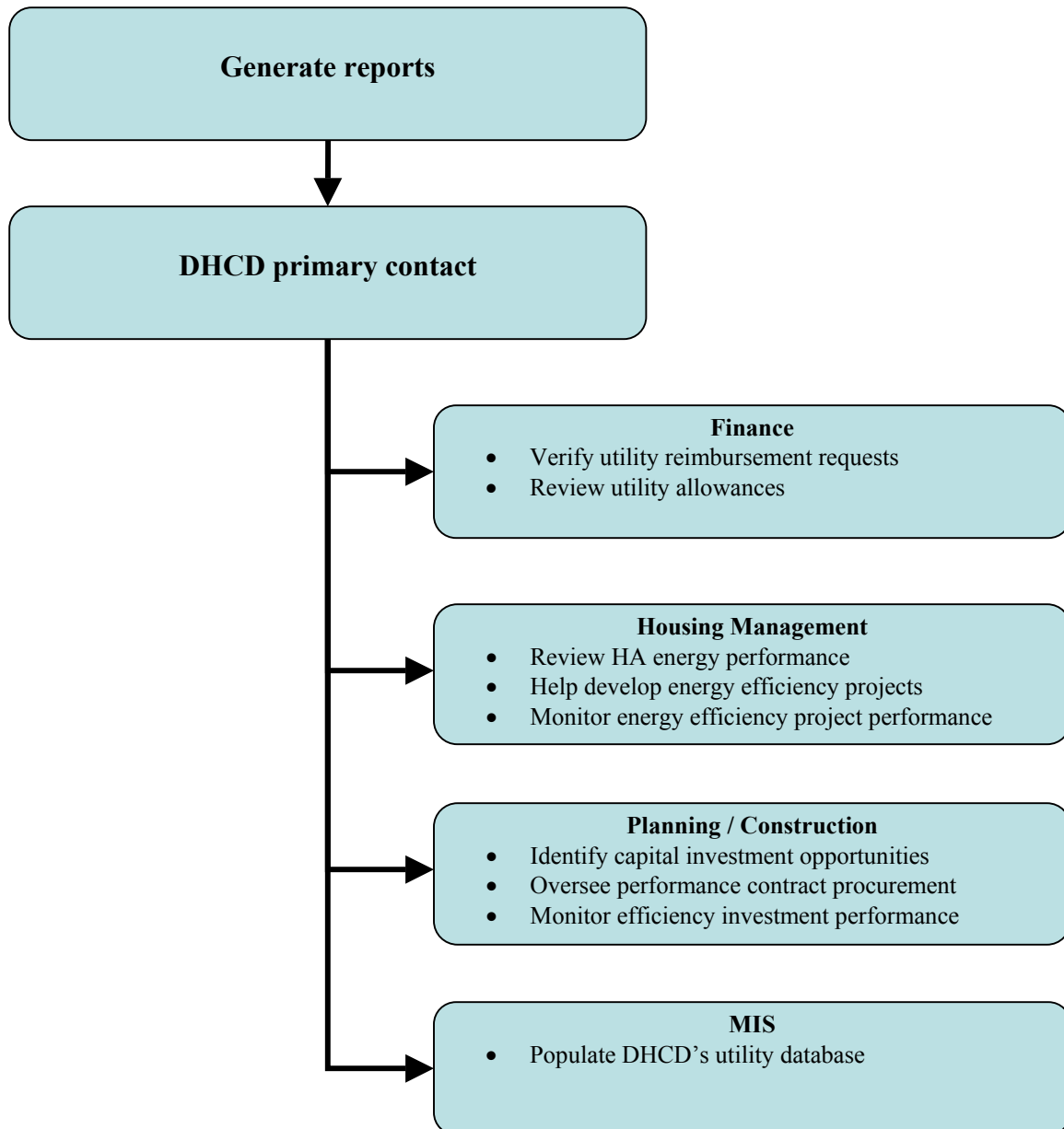
**Step 3:
Analyze Data**



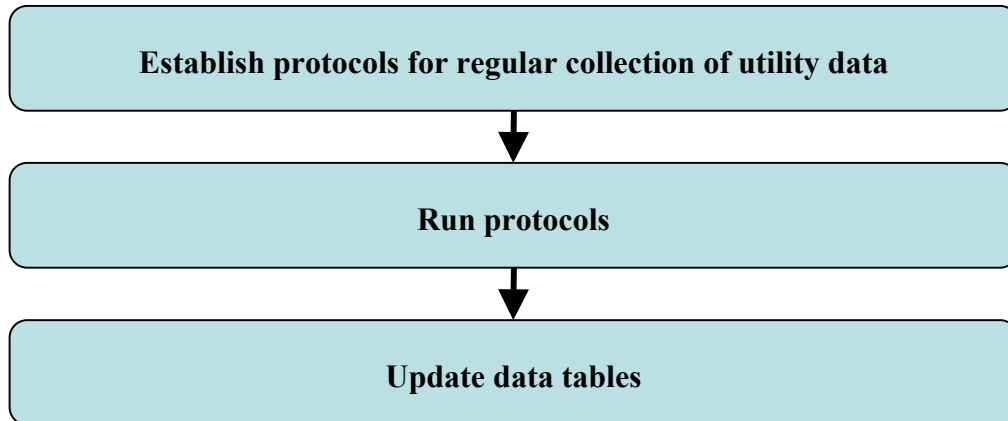
Step 4a:
Generate and Distribute Reports to Sample HA



Step 4b
Generate and Distribute Reports to DHCD



**Step 5:
Update Utility Data**



Appendix B: Housing Authority Data Tables

The following figures show some of the EIS utility and building data tables for the sample housing authority. The column for “Development Name” has been omitted. Figure 7 lists the utility provider for each meter, while Figure 8 provides a sample of the building data EIS staff collected for the building data table.

FIGURE 7: INDIVIDUAL METER UTILITY SUPPLIERS

| Development Number | Building(s) | Apt (s) | Utility | Who Pays Apt Use | Rate | Power Supplier |
|--------------------|-------------|---------|------------|------------------|------|----------------|
| | | | | | | |
| 1 | 1 | 1-8 | Electric | Other | | |
| 2 | 1 | 1-50 | Electric | Residents | | |
| 3 | 1-5 | 1-30 | Electric | HA | G2A | Third Party |
| 3 | 1-5 | Street | Electric | HA | S1A | |
| 4 | 1 | 31-60 | Electric | HA | G2B | Third Party |
| 5 | 1-6 | 1-43 | Electric | HA | G2B | Third Party |
| 5 | 1-6 | Street | Electric | HA | S4A | |
| 6 | 1 | 1-120 | Electric | HA | G3A | Third Party |
| 7 | 1 | 28 | Electric | HA | R1A | |
| 7 | 1 | Street | Electric | HA | S1A | |
| 8 | 1 | 1-13 | Electric | HA | G1A | |
| 1 | 1 | 1-8 | Gas | Other | | |
| 2 | 1 | 1-50 | Gas | Residents | | |
| 3 | 1 | 1-6 | Gas | HA | G-41 | |
| 6 | 1 | 1-120 | Gas | HA | G-51 | |
| 7 | 1 | 28 | Gas | HA | R-3 | |
| 1 | 1 | 1-8 | Town Water | Other | | |
| 2 | 1 | 1-3 | Town Water | HA | | |
| 3 | 1 | 1-6 | Town Water | HA | | |
| 4 | 1 | 31-60 | Town Water | HA | | |
| 5 | 1 | 1-8 | Town Water | HA | | |
| 6 | 1 | 1-120 | Town Water | HA | | |
| 7 | 1 | 28-30 | Town Water | HA | | |
| 8 | 1 | 1-13 | Town Water | HA | | |

FIGURE 8: SAMPLE BUILDING DATA SUMMARY

| Development Number | Apt. # | Address | Bldg # | Bedrooms | Square Feet |
|--------------------|--------|---------|--------|----------|-------------|
| 1 | 1 | | 1 | 1 | 500 |
| 1 | 8 | | 1 | 2 | 650 |
| 2 | 1 | | 1 | 2 | 650 |
| 2 | 2 | | 2 | 4 | 950 |
| 2 | 3 | | 1 | 2 | 650 |
| 2 | 50 | | 14 | 3 | 800 |
| 3 | 1 | | 1 | 3 | 800 |
| 3 | 2 | | 1 | 2 | 650 |
| 3 | 30 | | 5 | 2 | 650 |
| 4 | 1 | | 1 | 1 | 500 |
| 4 | 30 | | 1 | 1 | 500 |
| 5 | 1 | | 1 | 1 | 500 |
| 5 | 2 | | 1 | 1 | 500 |
| 5 | 43 | | 6 | 1 | 500 |
| 6 | 1 | | 1 | 1 | 500 |
| 6 | 102 | | 1 | 1 | 500 |
| 7 | 28 | | 1 | 3 | 800 |
| 7 | 30 | | 1 | 3 | 800 |
| 7 | 31 | | 2 | 3 | 800 |
| 7 | 32 | | 3 | 3 | 800 |
| 7 | 33 | | 2 | 3 | 800 |
| 7 | 34 | | 3 | 3 | 800 |
| 7 | 35 | | 4 | 3 | 800 |
| 7 | 36 | | 5 | 3 | 800 |
| 7 | 37 | | 4 | 3 | 800 |
| 7 | 38 | | 5 | 3 | 800 |
| 8 | 28 | | 1 | 1 | 500 |
| 8 | 30 | | 1 | 2 | 650 |
| 8 | 31 | | 1 | 3 | 800 |
| 8 | 32 | | 1 | 2 | 650 |
| 8 | 33 | | 1 | 3 | 800 |
| 8 | 34 | | 1 | 2 | 650 |
| 8 | 35 | | 1 | 3 | 800 |
| 8 | 36 | | 1 | 2 | 650 |
| 8 | 37 | | 1 | 3 | 800 |
| 8 | 38 | | 1 | 1 | 500 |

End Use Data

Utility end uses include basic services such as heat, hot water (DHW), cooking, laundry, air conditioning, and lights and appliances. Figure 9 summarizes sources of energy by end use for the Sample HA's developments. This information allows energy analysts to perform an apples-to-apples comparison of apartment energy use based on similar end uses.

FIGURE 9: ENERGY END USE SUMMARY

| Number | # of buildings | # of apts | Heat | DHW | Cooking | Laundry | A/C | Lights & Appliances | Common Electricity | Street Lights |
|--------------|----------------|------------|------|------|---------|---------|---------|---------------------|--------------------|---------------|
| 1 | 1 | 8 | | | | | | Elec | Elec | Elec |
| 2 | 14 | 27 | Gas | Gas | Gas | Gas | Window | Elec | Elec | Elec |
| 3 | 5 | 30 | Elec | Gas | Elec | | Window | Elec | Elec | Elec |
| 4 | 1 | 30 | Elec | Elec | Elec | Elec | Window | Elec | Elec | Elec |
| 5 | 6 | 43 | Elec | Elec | Elec | | Window | Elec | Elec | Elec |
| 6 | 1 | 120 | Elec | Gas | Elec | Elec | Central | Elec | Elec | Elec |
| 7 | 5 | 10 | Gas | Gas | Gas | Gas | Window | Elec | Elec | Elec |
| 8 | 1 | 11 | Gas | Gas | | | Window | Elec | Elec | Elec |
| 9 | | 2 | Elec | Elec | Elec | | Window | Elec | Elec | Elec |
| | | | | | | | | | | |
| Total | 34 | 281 | | | | | | | | |

Who Pays the Bill?

Another important consideration is who pays the utility bill. The Sample HA pays all the water bills and most of the electric and gas bills. The HA's landlord at one Development pays the utility bills for that building. Tenants pay the utility bills for their individual apartments in another development.

FIGURE 10 UTILITY BILL CUSTOMER SUMMARY

| Number | # of buildings | # of apts | Heat | DHW | Cooking | Laundry | A/C | Lights & Appliances |
|--------------|----------------|------------|--------|--------|---------|---------|--------|---------------------|
| 1 | 1 | 8 | Other | Other | Other | Other | Other | Other |
| 2 | 14 | 27 | Tenant | Tenant | Tenant | Tenant | Tenant | Tenant |
| 3 | 5 | 30 | HA | HA | HA | | HA | HA |
| 4 | 1 | 30 | HA | HA | HA | HA | HA | HA |
| 5 | 6 | 43 | HA | HA | HA | | HA | HA |
| 6 | 1 | 120 | HA | HA | HA | HA | HA | HA |
| 7 | 5 | 10 | HA | HA | HA | HA | HA | HA |
| 8 | 1 | 11 | HA | HA | | | HA | HA |
| 9 | 1 | 2 | HA | HA | HA | | HA | HA |
| | | | | | | | | |
| Total | 35 | 281 | | | | | | |